

STANDARD ENGINEERING DELIVERABLES

Document Type	Description	Construction Application
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GENERAL		
Specifications	Specifications define the technical, Quality Assurance Program requirements, and applicable codes established by the Architect Engineer or the Facilities Maintenance and Engineering organization. Specifications will be prepared in accordance with FMEP-P-0400, Specifications.	Ensures design parameters for construction and startup to verify components prior to and after installation.
Design Drawings	Design drawings are drawings that are issued for purposes such as design (i.e., used to establish the fundamental design configuration), procurement, construction, fabrication, etc. Drawings shall be properly checked for correctness and compliance to the client requirements, engineering standards and method of presentation. Design drawings are prepared in accordance with FMEP-P-0300, Engineering Drawings.	First line work task for construction is review of drawings for constructability.
Standard Abbreviation and Drafting Symbols	Refer to GS-05, Standard Abbreviation and Drafting Symbols	
Standard Drafting Details	Refer to GS-06, Standard Drafting Details	
General Notes and Symbols Legend		
Calculations	Refer to FMEP-P-0330, Design Calculations	
Supplier Engineering and Quality Verification Documents	Refer to FMEP-P-0410, Review of Supplier Engineering and Quality Verification Documents	
Design Criteria		

ARCHITECTURAL		
Landscaping Plans and Details	Shows planting, landscape and irrigation plans, plant material, and irrigation schedule and installation details.	Enables the preparation of a field contract for landscaping and development of plans for final area turnover to client.
Life Safety Plans (Code requirements, Paths of Egress, Rated Separations)		

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Floor Plans	Plan view of all building floors showing location and arrangement of architectural components.	Allows the construction team to become familiar with floor Architectural plan details. From this construction may plan subcontract and material purchase study.
Equipment/Furniture Plans		
Roof Plans	Plan view of each building roof showing materials, drainage, equipment, and any special details.	Allows the construction team to become familiar with roof details. From this construction may plan subcontract and material purchase study.
Building Cross Sections	Shows sections through buildings to show relation of walls and roof to structure, heights and materials.	Allows the construction team to become familiar with building details. From this construction may plan subcontract and material purchase study.
Wall Sections and Details	Shows at a larger scale the assembly of materials and systems in each type of building wall.	Allows the construction team to become familiar with building details. From this construction may plan subcontract and material purchase study.
Building Exterior Elevations	Shows each building façade identifying materials and arrangement of architectural elements.	Allows the construction team to become familiar with building facade materials and details. From this construction may plan subcontract and material purchase study.

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Enlarged Floor Plans	Plans of partial areas of building, enlarged to more clearly show arrangement and details.	Allows the construction team to become familiar with building details. From this construction may plan subcontract and material purchase study.
Building Interior Elevations	Large scale plan/section details for special interior conditions.	Allows the construction team to become familiar with interior building details. From this construction may plan subcontract and material purchase study.
Reflected Ceiling Plans and Details	Plans of ceilings showing fabrication and installation details.	Allows the construction team to become familiar with ceiling configurations and details as well as integration and coordination of other discipline commodities to be installed in the ceiling area. From this construction may plan subcontract and material purchase study.
Stairs, Plans and Sections	Shows plan and section view of stairs and stair shafts.	Enables the fabrication and erection of building stairs.
Elevator Plans, Sections, and Details	Plan and section view of elevator hoistway.	Enables the preparation of a field contract for elevator construction.
Door and Frame Schedule	List of doors, sizes, types, and reference details. Shows head, jamb, and sill conditions for each type door for each wall/floor condition. Provide each door with a unique identification number and door hardware schedule.	Allows the construction teams to prioritize the delivery of facility doors for the door fabricator. Enables the construction team to understand door installation requirements. From this construction may plan subcontract and material purchase study.
Door and Frame Details and Elevations		

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Wall Type Schedules .	List of interior walls, sizes, construction types, and reference details. Shows anchorage and penetration conditions for each wall.	Enables the construction team to understand design requirements. From this construction may plan subcontract and material purchase study.
Finish/Paint Schedule	Lists each building room and specifies ceiling, wall, and floor substrates and finishes.	Allows facility coatings work activities to be scheduled.
Window Type and Details	List of windows including size, types, reference details, and specific details showing head, jamb, and sill conditions for each wall condition. Provide each window with a unique identification number.	Allows window deliveries to be prioritized and tracked. From this construction may plan subcontract and material purchase study
Louver Schedule and Louver Details	List of louvers including size, types, reference details, and specific details showing head, jamb, and sill conditions for each wall condition. Provide each louver with a unique identification number.	Allows louver deliveries to be prioritized and tracked. From this construction may plan subcontract and material purchase study.
Building Exterior Details	Large scale plan/section details for exterior conditions.	Allows the construction team to become familiar with the final appearance of the completed facility and exterior construction and finish details. From this construction may plan subcontract and material purchase study.
Roof Details		
Miscellaneous Details		

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CIVIL/STRUCTURAL		
Standard Details and Notes:	<p>: The project selects those needed and shows them on a set of standard project drawings. These details include those items that do not need to be uniquely designed for a specific set of loads or job conditions. They include but are not limited to:</p> <ul style="list-style-type: none"> • Small yard structures (fences, gates, etc) • Sediment and erosion control structures (storm basins, riprap details, etc.) • Roads and paving, including road markings, guard rail details, curbs, etc. • Storm Drainage (ditches, head walls, man-holes, catch basins, storm inlets, etc.) • Parking Lot details • Survey monuments • Typical concrete construction details (rebar configurations for walls, rebar splicing details, concrete stairs, construction joints, etc.) • Metal decking details • Grating details • Structural steel bracing and connection details • Precast concrete panel details • Equipment pads • Anchor bolt details • Miscellaneous steel details such as stairs, ladders, safety cages, and handrails. • Concrete Masonry Unit (CMU) wall details 	Use of standard details ensures that constructability input to corporate standards is included in the project design.
Site Plan	Shows the facility layout, location of yard structures and features including drainage and roads.	Enables layout of the site.
Piling Plan	Shows the location, size, and type of piles. Also shows concrete dimensions and rebar requirements for pile caps.	Enables the layout of pile locations.

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Existing Site Contours	Provides contours of the site prior to beginning construction and/or site improvements.	The design and construction teams compare existing and final excavation plans to calculate cut and fill quantities.
Utility profiles		
Boring Location Plan	Used to locate site soil exploration borings needed to establish foundation conditions.	Enables the planning of site excavation work activities using the boring information to define subsurface conditions.
Geotechnical Investigation		
Settlement Monitoring	Provides locations of monuments and requirements for settlement monitoring (if required). Provide a unique identification number for each monument.	Enables the establishment of the site settlement monitoring system and the collection of settlement data during construction.
Rough Grading Plan and Details	Show initial grading and erosion control measures	The design and construction teams compare existing contour and rough grading plans to calculate cut and fill quantities.
Finish Grading and Paving Plan and Details	Provides and locates final grade elevations, road types, and details (e.g. curbing, guard rail locations, etc.)	Enables the layout of finish grading and paving.
Stormwater/Sanitary Drainage Plan and Details	Defines all drainage routes, sources, and systems (e.g. piping, manholes, etc.).	Enables the layout of stormwater and sanitary drainage systems and structures.
Sediment and Erosion Control Plan and Details		

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Demolition Drawing	Identifies structures and facilities that must be cleared from the site.	Enables the implementation of required site demolition. is integrated into the final design.
Structure and Equipment Foundation Plan and Details	Shows concrete dimensions, type of concrete, special details, anchor bolts, embeds, rebar requirements, location of equipment pads, blockouts, construction joints, and expansion joints.	Enables the quantity take-off, layout, and construction of required foundations In conjunction with embedded metals, formwork, and rebar detail drawings.
Grade Slabs Plans and Details	Shows concrete dimensions, types of concrete, cricket lines, anchor bolts, embeds, and rebar requirements for grade slabs. These drawings may be combined with structure foundation drawings.	Enables the quantity take-off, layout, and construction of required grade slabs.
Elevated Concrete Slab Plans and Details .	Shows concrete dimensions, type of concrete, special details, anchor bolts, baseplates, rebar requirements, location of equipment pads, blockouts, construction joints, embeds, openings, penetration, and expansion joints	Enables the quantity take-off, temporary shoring design, formwork design, layout, and construction of required concrete slabs.
Structural Schedules		
Building Reinforcing Plans and Details	Shows rebar location, size, spacing, and bending requirements. Alternatively, this information may also be shown directly on the foundation, elevated slab, or building section drawings if there is sufficient room to show the	Enables the quantity take-off, detailing, layout, and installation of required reinforcing.

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Precast Concrete Plan, Sections, and Detail	<p>Shows plans, elevations, locations and details of precast concrete panels including dimensions, "top of concrete" elevation for horizontal members, type of concrete, finish requirements, special details, rebar requirements, joint details, and connection details.</p> <p>Shows detailed drawings of all precast members showing the face to face dimensions, location of embedded items, reinforcement steel, chamfers and connections (including weld sizes and lengths).</p> <p>Shows plans and elevations of all cast in place concrete walls with dimensions, locations, "top of concrete" elevations, penetrations, sleeves, embedded items, grout pockets, reinforcement steel locations and details, construction joints, crack control joints, decking with orientation of ribs, anchor bolts and equipment centerlines.</p> <p>Each panel to be provided with a unique identification number.</p>	<p>Enables the preparation of a field contract for precast concrete fabrication and enables the prioritization and tracking of site deliveries.</p> <p>Also enables field erection of precast panels.</p>
Structural Steel Elevations, Sections, and Detail	Shows structural steel elevations and additional sections and details necessary to completely describe the structural steel framing. Fire proofing of steel sections should also be shown. Design loads should be shown where required.	Enables the detailing, fabrication, layout, and erection of building structural steel.
Structural Steel Framing Plans.	Shows structural steel framing and member sizes of all steel members. It should also show grating, metal decking handrail, toe plates, shear studs to beams, metal decking and sleeve penetrations and design loads where required	Enables the detailing, fabrication, layout, and erection of building structural steel.
Miscellaneous Steel Drawings	Shows the location, dimensions, and member sizes for miscellaneous platforms, and other miscellaneous structural steel. Alternatively, this information may be shown on the main structural steel framing drawings.	Enables the detailing, fabrication, layout, and erection of building miscellaneous steel.
Pipe Rack or Piping Bridge Framing, Elevations, and Details	Shows locations, dimensions, member sizes, and connection details for pipe racks.	Enables the detailing, fabrication, layout, and erection of pipe rack steel.

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MECHANICAL (HVAC)		
General Arrangement/Equipment Location	Shows building outlines, floor elevations, stairwells, general access area for personnel and locations of equipment. These drawing files may also be used as backgrounds for equipment location, cable tray, conduit, HVAC, fire extinguishers locations, instrument stands/rack locations, pipe racks and piping drawings.	Enables work planning of erection sequence at the construction site by permitting visualization of the work to be performed.
Equipment Drawings	Shows details of major mechanical/HVAC equipment.	Enables visualization of space requirements and planning of erection sequence.
Ductwork Arrangements	Shows details of ductwork size and layout.	Enables visualization of duct routing, construction planning, and sequencing.
Piping Arrangements	Shows details of pipe sizing and routing.	Allows construction team to become familiar with piping layout.
Air Flow Diagrams	Shows required airflows in all areas (rooms, hallways, labs, and offices, etc.) of a given building.	Allows the constructor to properly test and balance airflows in the building to achieve as designed HVAC conditions.
System P&ID's	A schematic representation of the functional relationship among equipment, piping, instrumentation and process control for a given system. P&IDs define the flow of the process, indicates the quantities of equipment and components, characterizes the control and instrumentation, and identify components furnished by others. P&IDs shall include sheets for notes, symbols and details.	Primary source of information on facility system lines, equipment, valves, and in-line devices (e.g. strainers, surge suppressors, flow elements, etc.).

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MECHANICAL (PIPING)		
P&ID Diagrams for Process, Utility, Plumbing and fire protection systems	Shows all equipment connections, process flow, and overall system configuration.	Enables visualization of how all of the equipment is connected, process flow sequence, and cross connections.
Plumbing Riser Diagrams	Shows how all piping is routed to different areas and rooms of the building.	Allows construction team to visualize the piping layout and to plan a construction sequence..
Piping Line List	Shows pipe line numbers, classifications, and sizes.	Enables visualization of required pipes by size and material.
Piping Arrangement Drawings	Shows building outlines, stairwells, general access areas for personnel, and location of piping. These drawing files may also be used as backgrounds for equipment location, cable tray, conduit, HVAC, fire extinguishers locations, instrument stands/rack locations, pipe racks and piping drawings.	Enables work planning of erection sequence at the construction site by permitting visualization of the work to be performed.
Piping Isometric Drawings	All piping dimensions, piping specs, components, attachments, supports (including hanger number and relative location), orientation of orifice flange taps, floor penetrations & grating, column line location, overall equivalent pipe length, slope direction symbol & rate of slope, flush points, piping specification class breaks and system breaks, identification of field welds (including weld numbers), pipe spool numbers, and instruments are shown and located by the isometric drawing.	Used for piping fabrication and installation. Enables site personnel to place bulk material on order prior to ISO issue and instrumentation details issued. Supports early planning of start up for system turnover during the construction phase.
Piping Support Drawings	Shows details by pipe support.	Enables determination of required material for pipe supports and provides a means to locate these supports.

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INSTRUMENTATION/CONTROL & BUILDING AUTOMATION SYSTEMS

Instrument Location Plans	Shows the physical location of instruments, instrument taps and space allocation for racks and instrument panels. Use existing electrical layout drawings.	Supports field installation of instrumentation systems.
Control Panel(s) Arrangement and Detail:	Shows the physical instrumentation arrangement and details of the main and auxiliary control panels	Supports field installation of instrumentation systems.
Distributed Control System Block Diagram:	Defines the system architecture and equipment interconnection.	Supports field installation and checkout of the DCS system.
Sequence of Operations		
Equipment Operational Setpoints, Alarm Setpoints and Alarm Routing details		
Wiring diagrams	Shows wiring between sensors, transmitters, input and output devices, and the BAS cabinets.	Supports installation, material takeoff, procurement, startup, and troubleshooting,

ELECTRICAL

Schematic Diagrams	Schematic diagrams will be issued for all devices controlled from switchgear or motor control centers as well as other hard wired control circuits.	These documents are essential to checkout and troubleshooting. While the work can be accomplished using numerous other pieces of documentation, many hours of startup and craft time are saved by eliminating research time and effort trying to determine how a system, or circuit is intended to work or why the system is not working the way it should. Supports Start up scoping and turnover plan.
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Single Line Diagrams	Depicts configuration and ratings of electrical equipment and busses for AC, DC and 400v and higher systems. Also depicts feeder cable sizes to the distribution equipment.	Enables checkout of electrical systems at the site (as built). Supports startup scoping and turnover plan.
Typical Bus Metering and Three Line Diagrams	Shows in a three line format connections for bus metering and protective relaying connections.in	Supports installation, system operation checkout, and startup operations.
Site Plan	Depicts underground and overhead routing of electrical cables in duct banks and overhead poles. Shows location of major electrical equipment located outdoors.	Supports installation, material list , and procurement.
Grounding Plan, Layout, and Connection Details	Depicts building grounding, electrical system grounding, and equipment grounding.	Enables material purchasing, tracking and field installation of the facility grounding system.
Raceway Plan Sections & Detail	Shows installation and material requirements for electrical raceway including bus ducts, cable tray, conduit, and ductbanks/manholes. Provides raceway sizes and arrangements. All conduits are shown diagrammatically. The actual routing of the conduit is performed by the contractor or electrical shop.	Enables material take-off, material tracking, and installation of electrical raceway.
Electrical Equipment Location Plans, Elevations and Details, including Motor and Valves	Shows arrangement layout and cross-sections of electrical equipment including dimensions, access door details, and wire ways.	Enables field planning for installation of electrical equipment. Identifies total electrical equipment to be tracked.
Distribution Panelboard, Power Loadcenter, Switchgear Schedule	Shows the physical arrangement and details of the electrical distribution panels. Includes breaker arrangement, breaker sizes, breaker types, and load assignment.	Supports field system installation. Allows preparation for procurement documents.
High voltage Distribution Plans and Details	Shows connection to pole and conduit detail.	Supports installation, material take off, and procurement.
Lighting Protection Plans and Details	Shows details to support construction.	Supports installation, material take off, and procurement.
Lightning Protection	Layout drawing showing the area protected by the lightning protection design.	Enables field take-off material tracking and installation of lightning protection system.

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MCC Schedules, Elevations and Details	Shows arrangement layout, breaker size and type, starter and contactor size and type, overload relay size and type and setting, relay type and any bus monitoring, metering and protective devices.	Supports installation, material take off, and procurement.
Emergency Power Layout and Details	Shows location of equipment and any details required for installation.	Supports installation, material take off, and procurement.
Lighting and Lighting Fixture Schedule	Shows lighting layout and lighting fixture types, and recommended manufacturers.	Supports installation, material take off, and procurement.
Power Plans and Details	Shows location of receptacles and details for items such as lab bench power.	Supports installation, material take off, and procurement.
Transformer and Transformer Pad Details	Shows transformer mounting details, transformer location and conduit stubup.	Supports installation, material take off, and procurement.
Panel Schedules for Lighting	Shows panel breaker assignments, spares, and spaces.	Supports installation, material take off, and procurement.
Ductbank Plans and details	Cross section or elevation details.	Supports installation, material take off, and procurement.
Details for Special Equipment or Systems	Shows detail for equipment such as hood alarms.	Supports installation, material take off, and procurement.
Fire Alarm Plans, Details and Zone schedules	Shows location of heat and smoke detectors, visual and audible alarms, and water flow detectors.	Supports installation, material take off, and procurement.
Communication Plans and details (LAN, Data, Telephone< Intercom, Fiber Optic)	Shows riser diagrams, layout, and arrangement.	Supports installation, material take off, and procurement.
Scientific Alarm, LAN, and Telephone Plans and Details	Shows equipment alarm location, LAN jack location, and telephone jack location.	Supports installation, material take off, and procurement.
Cardkey Card Access and Details	Diagram of cardkey system cabling.	Supports installation, material take off, and procurement.
Riser Diagram for Communication, etc.	Shows location of intercom jacks and equipment.	Supports installation, material take off, and procurement.

